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## Description of two new species of *Cryptinglisia* Cockerell (Hemiptera: Coccoidea: Coccidae) associated with rosemary, *Rosmarinus officinalis* L. (Lamiaceae) in Colombia

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### Abstract

In this study, two new species of soft scale (Hemiptera: Coccoidea: Coccidae) associated with rosemary, *Rosmarinus officinalis* L. (Lamiaceae) from Colombia, *Cryptinglisia corpoica* Kondo & Montes sp. nov. and *Cryptinglisia ica* Montes & Kondo sp. nov. are described and illustrated based on the adult female. Two other coccid species, namely *Parasaissetia nigra* (Nietner) and *Saissetia coffeae* (Walker), are newly recorded on rosemary. An identification key is presented to all species of soft scale that have been reported on *Rosmarinus* spp. An updated key to soft scale insects of the genus *Cryptinglisia* Cockerell is provided also.

**Key words:** coccid, insect pest, soft scale insect, Sternorrhyncha, identification key

### Resumen

En este estudio, dos nuevas especies de escamas blandas (Hemiptera: Coccoidea: Coccidae) de Colombia, *Cryptinglisia corpoica* Kondo & Montes sp. nov. y *Cryptinglisia ica* Montes & Kondo, sp. nov. asociadas al romero, *Rosmarinus officinalis* L. (Lamiaceae) se describen e ilustran con base en la hembra adulta. Dos especies de escamas blandas, *Parasaissetia nigra* (Nietner) y *Saissetia coffeae* (Walker) se registran por primera vez sobre romero. Se presenta una clave para todas las especies de escamas blandas (familia Coccidae) reportadas sobre *Rosmarinus* spp. También se provee una clave actualizada para las escamas blandas del género *Cryptinglisia* Cockerell.

### Introduction

Rosemary, *Rosmarinus officinalis* L. (Lamiaceae) is one of the most important cultivated crops in the market of aromatic and medicinal plants worldwide (Álvarez-Herrera *et al.* 2007; Zanella *et al.* 2012). It is commonly used as a spice for its flavor and aroma (Álvarez-Herrera *et al.* 2007; CCI 2015), and due to its specific chemical, biochemical or organoleptic properties, rosemary is used for therapeutic, aromatic and dietetic or gastronomic purposes (Avila-Sosa *et al.* 2011). It also has stimulant, tonic and medicinal properties, and is used in perfumery, aromatherapy, industrial and pharmaceutical products (Sasikumar 2004; Álvarez-Herrera *et al.* 2007). In

Colombia, rosemary is traditionally used to prevent hair loss, and to treat heart and nerve disorders, neuralgia and, less frequently, lung problems such as coughing, asthma and influenza (Arango-Caro 2006); 9.5% of Colombian production of aromatic and medicinal plants is rosemary (Ramírez *et al.* 2006). The herb also accounts for 12% of the total exports of aromatic and medicinal plants from this country (Bareño & Clavijo 2006). Trade in rosemary is one of the most significant products in the increased trade in aromatic plants between Colombia and the United States and European Community (Arévalo *et al.* 2013).

In 2014, the United States Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS) notified the Colombian Agricultural and Livestock Institute (ICA) about interceptions at U.S. ports of entry of a soft scale species of the genus *Cryptinglisia* Cockerell (Hemiptera: Coccidae) on rosemary plants from Colombia. Initial reports from USDA-APHIS had tentatively identified the intercepted soft scale as *Cryptinglisia lounsburyi* (Cockerell), a species not previously reported from Colombia. To investigate these interception reports, the Technical Directorate of Epidemiology and Phytosanitary Surveillance of ICA initiated general and specific surveillance activities to define the status of the above-mentioned species. The official control pest surveillance group initiated specific monitoring activities in the main rosemary producing areas of Colombia. Rosemary exporting companies and their respective production farms were prioritized, and this resulted in a detection report on soft scales in the departments of Antioquia, Boyacá and Cundinamarca. Monitoring activities were conducted at 15 randomly selected sites, where the presence or absence of soft scales was determined, as well as the sooty mold symptoms associated with them. A total of 118 follow-up visits were made to rosemary producing farms.

The presence of species of the genus *Cryptinglisia* was confirmed on six farms in Cundinamarca, two farms in Boyacá and three farms in Antioquia. Two undescribed species of the genus *Cryptinglisia* were found and the presence of *C. lounsburyi* in rosemary crops from the studied area was ruled out. Herein we describe and illustrate the adult females of two new species of *Cryptinglisia* collected on rosemary. In addition, two cosmopolitan coccid species, *Saissetia coffeae* (Walker) and *Parasaissetia nigra* (Nietner), were found on rosemary in Cundinamarca and Antioquia, which are the first records of these polyphagous species from rosemary.

There are currently 50 known scale insect families, of which 34 are extant and 16 are known only as fossils (García Morales *et al.* 2016). The soft scales (Coccidae) belong to an informal group of scale insects known as neococcoids (Kondo *et al.* 2008). According to the scale insect database ScaleNet, eight species of soft scales have been recorded on *Rosmarinus* spp. worldwide: *Ceroplastes cirripediformis* Comstock, *Ceroplastes sinensis* Del Guercio, *Coccus hesperidum* Linnaeus, *Cryptinglisia zizyphi* (Brain), *Lichtensia viburni* Signoret, *Parthenolecanium corni* (Bouché), *Philephedra tuberculosa* Nakahara & Gill, and *Saissetia oleae* (Olivier) (García Morales *et al.* 2016).

*Cryptinglisia* currently includes six species: *C. chilensis* Kondo & Gullan, *C. elytropappi* (Brain), *C. lounsburyi* (Cockerell), *C. millari* Gavrilov-Zimin, *C. patagonica* Granara de Willink and *C. ziziphy* (Brain) (García Morales *et al.* 2016). With the addition of two new species herein described, the number of *Cryptinglisia* species is elevated to eight, of which three can be found on *Rosmarinus* species. Here we provide a taxonomic key to separate all 12 species of soft scale recorded on *Rosmarinus*, and provide an updated key to identify all the species included in *Cryptinglisia*.

## Material and methods

Samples were taken to the ICA national phytosanitary diagnostic laboratory at their Tibaitatá headquarters in Mosquera, department of Cundinamarca, and to the phytosanitary diagnostic laboratory based in Cúcuta, department of Norte de Santander. Some samples were also sent to the entomology laboratory of Corpoica, Palmira Research Station, in Palmira, department of Valle del Cauca. The soft scale specimens were slide-mounted following the method described by Williams & Granara de Willink (1992). Identification to genus level was made following Hodgson's (1994) dichotomous keys to genera of the family Coccidae; the generic diagnosis and key to species of *Cryptinglisia* provided by Kondo & Gullan (2010) was also used. Morphological features of the adult female follow those defined by Kondo & Gullan (2010). Measurements of the studied specimens were made using an ocular micrometer attached to a Nikon Eclipse E200 phase contrast compound microscope; measurements of the holotype specimen are given in parentheses. The taxonomic illustrations of the new species follow the traditional convention for the superfamily Coccoidea, with the dorsal surface shown on the left side and the ventral surface on

the right side of the drawing, with enlargements of important features placed around the illustration. The number of specimens used for each description is given in parentheses, e.g. (n=50). Under material studied, the number of slides and specimens on each slide are given as the number of slides followed by the total number of specimens; e.g., “1(3)” means one slide containing three adult females. When growth stages other than the adult female are present within a single slide, then the number of slides is followed by the total number of specimens, and the growth stage in parentheses. For example, one slide with four specimens, of which three are adult females and a second-instar female, is represented as follows: 1(4: 3 adult females + 1 second-instar female). This is followed by the depositories in parentheses. The character states used in the taxonomic keys to species were based on published literature and on findings of the present study.

Insect specimens were collected under a collecting permit “Permiso marco de recolección de especímenes de especies silvestres de la diversidad biológica con fines de investigación científica no comercial” [Permit framework for collecting of specimens of wild species of the biological diversity for non-commercial scientific research purposes], resolution No. 1466, expedited on December 3, 2014, by the Autoridad Nacional de Licencias Ambientales (ANLA) [Colombian National Authority Environmental Permits].

#### Specimen depositories

<b>CTNI</b>	Colección Taxonómica Nacional de Insectos “Luis María Murillo”, Corporación Colombiana de Investigación Corpoica, Mosquera, Cundinamarca, Colombia.
<b>USNM</b>	National Museum of Natural History Entomological Collection, Washington, DC, U.S.A. (Coccoidea collection held at USDA, Beltsville, Maryland)
<b>ICALNDF</b>	Colección entomológica del Laboratorio Nacional de Diagnóstico Fitosanitario del Instituto Colombiano Agropecuario, Tibaitatá, Cundinamarca, Colombia.

#### Results

The samples of *Cryptinglisia* collected from twigs of *R. officinalis* in Colombia were determined to be two undescribed species, described below as new to science.

#### Key to species of soft scales (Hemiptera: Coccoidea) associated with *Rosmarinus* spp. (Lamiaceae) (adapted from Hamon & Williams 1984; Gill 1988; Hodgson 1994; and Nakahara & Gill 1985).

1. Spiracular setae numbering more than 3 per stigmatic area, each seta stout, conical / hemispherical / bullet-shaped; anal plates located on a sclerotized anal process. .... 2
- Spiracular setae usually numbering 1–3 per stigmatic area, spine-like; anal plates not located on a sclerotized anal process . 3
2. Filamentous ducts present on ventral submargin; perivulvar pores restricted to area around vulva, with few present on preceding abdominal segments; anal plates each with 2 ventral subapical setae ..... *Ceroplastes sinensis* Del Guercio
- Filamentous ducts completely absent from ventral submargin; perivulvar pores found on area around vulva and anteriorly on all abdominal segments and near bases of meso- and metathoracic legs; anal plates each with 1 ventral subapical seta ..... *Ceroplastes cirripediformis* Comstock
3. Anal plates each with a large discal seta; marginal setae simple, blunt, slightly broadened or with a few fringes; tibio-tarsal sclerosis usually present ..... 4
- Anal plates each without a large discal seta; marginal setae variable; tibio-tarsal sclerosis present or absent ..... 5
4. Ventral tubular ducts in submarginal band of 2 types: one with inner ductule as broad as outer ductule and the other with thin or filamentous inner ductule ..... *Saissetia coffeae* (Walker)
- Ventral tubular ducts in submarginal band of 1 type, with slender inner ductule ..... *Saissetia oleae* (Olivier)
- 5(3). Dorsal derm becoming heavily sclerotized in older specimens, with polygonal reticulations. Dorsal setae each parallel-sided, with apex clavate (occasionally blunt / flattened and slightly digitate). Marginal setae apically flattened and broadly frayed .. *Parasaissetia nigra* (Nietner)
- Dorsal derm membranous or sclerotized, without polygonal reticulations. Dorsal setae present or absent, when present shape variable, either with parallel sides and blunt or tapering apex or finely or bluntly spinose, apex never clavate. Marginal setae variable ..... 6
- 6(5). Submarginal band of ventral tubular ducts absent ..... *Coccus hesperidum* L.

-	Submarginal band of ventral tubular ducts present . . . . .	7
7.	Dorsal setae absent . . . . .	8
-	Dorsal setae present. . . . .	9
8.	Anal plates with setose setae; without a sclerotized area around anal plates. Dorsal tubular ducts present, of 2 types, one with a thin inner ductule with a small terminal gland and another with a broad inner ductule with well-developed terminal gland. Dorsal tubercles relatively large, present medially and submedially. Marginal setae spinose. Stigmatic setae numbering 3 per stigmatic area . . . . .	<i>Philephedra tuberculosa</i> Nakahara & Gill
-	Anal plates with stout setae; with a sclerotized area around anal plates. Dorsal tubular ducts and tubercles absent. Marginal setae conical, stout. Stigmatic setae, when present, numbering 1 or 2 (usually 1) per stigmatic area . . . . .	<i>Cryptinglisia</i> spp. ( <i>C. corpoica</i> sp. nov., <i>C. ica</i> sp. nov., and <i>C. zizyphi</i> ). For separation of species go to key to species of <i>Cryptinglisia</i> below.
9.	Dorsal tubercles present on submargins. Dorsal setae spine-like or conical, stout, with a blunt apex, of 2 sizes; smaller setae scattered on submedial and submarginal areas; larger setae present on medial areas anterior to anal plates forward to head region. Marginal setae spinose, with blunt apices, each basal socket not particularly narrow. Dorsal tubular ducts present, each with inner ductule broad and terminal gland well-developed . . . . .	<i>Parthenolecanium corni</i> (Bouché)
-	Dorsal tubercles absent. Dorsal setae finely setose, of 1 size, sparsely distributed. Marginal setae variable, mostly flattened and broadened apically, often dentate, each with narrow basal socket. Dorsal tubular ducts absent . . . . .	<i>Lichtensis viburni</i> Signoret

## Taxonomy

### COCCIDAE

#### Genus *Cryptinglisia* Cockerell

*Cryptinglisia* Cockerell, 1900: 173.

Type species: *Cryptinglisia lounsburyi* Cockerell, 1900: 173. By monotypy.

**Generic diagnosis.** Members of the genus *Cryptinglisia* can be diagnosed as follows: (1) insects in life covered by a semi-transparent, glassy and brittle test; (2) derm entirely membranous apart from a heavily sclerotized crescent around anal plates; (3) dorsal setae entirely absent; (4) anal plates heavily sclerotized, with thick spinose setae (usually less than 4 setae in each plate); (5) preopercular pores present in a linear group anterior to anal plates; (6) marginal setae sharply spinose or conical, with a broad base and well-developed basal socket; (7) legs usually well developed, with distinguishable coxa, trochanter, femur, tibia and tarsi, without tibio-tarsal sclerosis (but legs reduced in *C. elytropappi* and *C. millari*); (8) spiracles each surrounded by a sclerotization; (9) spiracular pores mostly with 5 loculi; (10) a single stigmatic spine (some specimens of *C. corpoica* sp. nov. with 2 stigmatic setae) per stigmatic cleft; (11) perivulvar pores usually mostly with 5 loculi (but perivulvar pores not known in *C. elytropappi* and *C. millari*); and (12) ventral tubular ducts of 1 type, present in a broad submarginal band, and medially.

**Remarks.** The two new species herein described fit well in the subfamily Cardiococcinae in Hodgson's (1994) book on the identification of coccid genera. However, they do not fit well in the genus *Cryptinglisia* in Hodgson's (1994) key because the two new species from Colombia have well-developed eyes, a feature that puts them close to *Dicyphococcus* Borchsenius and *Cardiococcus* Cockerell. However, the latter two genera both have a group of stigmatic setae in each stigmatic cleft. Other than the presence of eyes, the two new species fit well in *Cryptinglisia*.

#### Key to separate the known species of *Cryptinglisia* Cockerell

[Adapted from Brain (1920), De Lotto (1967), Gavrilov-Zimin & Chetverikov (2017), Granara de Willink (1999), Hodgson (1967, 1994) and Kondo & Gullan (2010)]

1.	Legs rudimentary, with reduced number of segments . . . . .	2
-	Legs normal, each with well-developed coxa, trochanter, femur, tibia and tarsus as typical for Coccoidea . . . . .	3
2.	Each stigmatic cleft containing 1 stigmatic seta; claw digitules similar in shape and size; rows of simple pores absent from body margin and along midline . . . . .	<i>C. elytropappi</i> (Brain)
-	Each stigmatic cleft containing 3 stigmatic setae in addition to an uninterrupted row of marginal setae; claw digitules dissimilar in shape and size, with 1 conspicuously thicker than the other; row of simple pores present along body margin and along mid-	

line ..... *C. millari* Gavrilov-Zimin

3. Stigmatic spines not differentiated from marginal setae. Posterior spiracular pore band incomplete, with only a few pores near area of posterior spiracle ..... *C. patagonica* Granara de Willink

- Stigmatic spines differentiated, totalling 1 (sometimes 2) per stigmatic cleft. Posterior spiracular pore band complete, extending from area around posterior spiracle to body margin ..... 4

4. Perivulvar pores present in small groups on either side of anal cleft only ..... 5

- Perivulvar pores present along either side of anal cleft, with some pores extending anterolaterally on posterior abdominal segments ..... 6

5. Marginal setae all of 1 length. Dorsal derm without areolations. Antennae 7 or 8 segmented ..... *C. lounsburyi* Cockerell

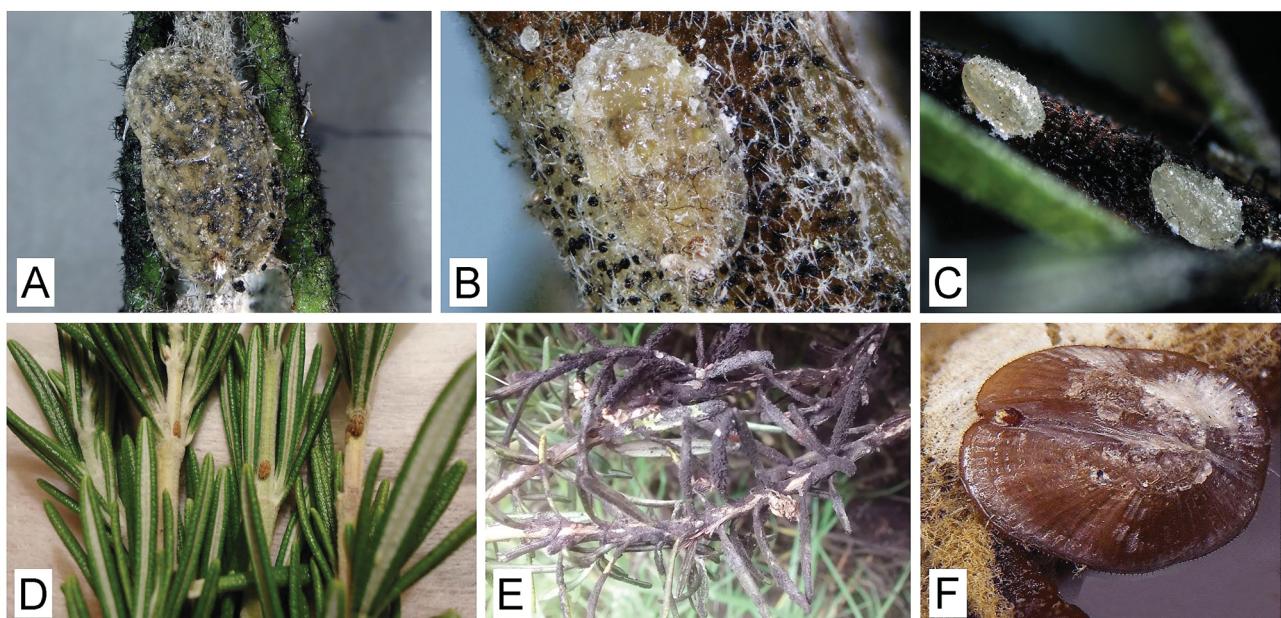
- Marginal setae of 2 lengths, 1 type conspicuously shorter than the other. Dorsal derm with areolations. Antennae 6 or 7 segmented ..... *C. corpoica* Kondo & Montes sp. nov. (Figs 1A, B & C; 2)

6. Preopercular pores present along midline from just anterior to anal plates to about mesothorax. Dorsal microducts each without a septum, appearing unilocular; sparsely scattered throughout dorsum, not intermixed with preopercular pores, nor present alongside marginal setae. Antennae 7 segmented ..... *C. chilensis* Kondo & Gullan

- Preopercular pores present along midline from just anterior to anal plates to head margin. Dorsal microducts each with a septum, appearing bilocular; intermixed with preopercular pores, also present alongside marginal setae. Antennae 5 to 8 segmented ..... 7

7. Test of live insect highly convex, like a small bivalve shell. Stigmatic spines bluntly spinose, each as long as a marginal seta. Thick and large ventral submarginal setae absent from anteriorly on head and from anal lobes. Antennae 5 or 6 segmented . . . . .  
..... *C. zizyphi* (Brain)

- Test of live insect only slightly convex, not shaped like a small bivalve shell. Stigmatic spines sharply spinose, each about twice as long as, or longer than a marginal seta. A pair of thick and large ventral submarginal setae present anteriorly near head (ventral cephalic setae); each anal lobe also with a thick and large seta (large anal lobe seta). Antennae 7 or 8 segmented . . . . .  
..... *C. ica* Montes & Kondo sp. nov. (Figs 1F, 3)

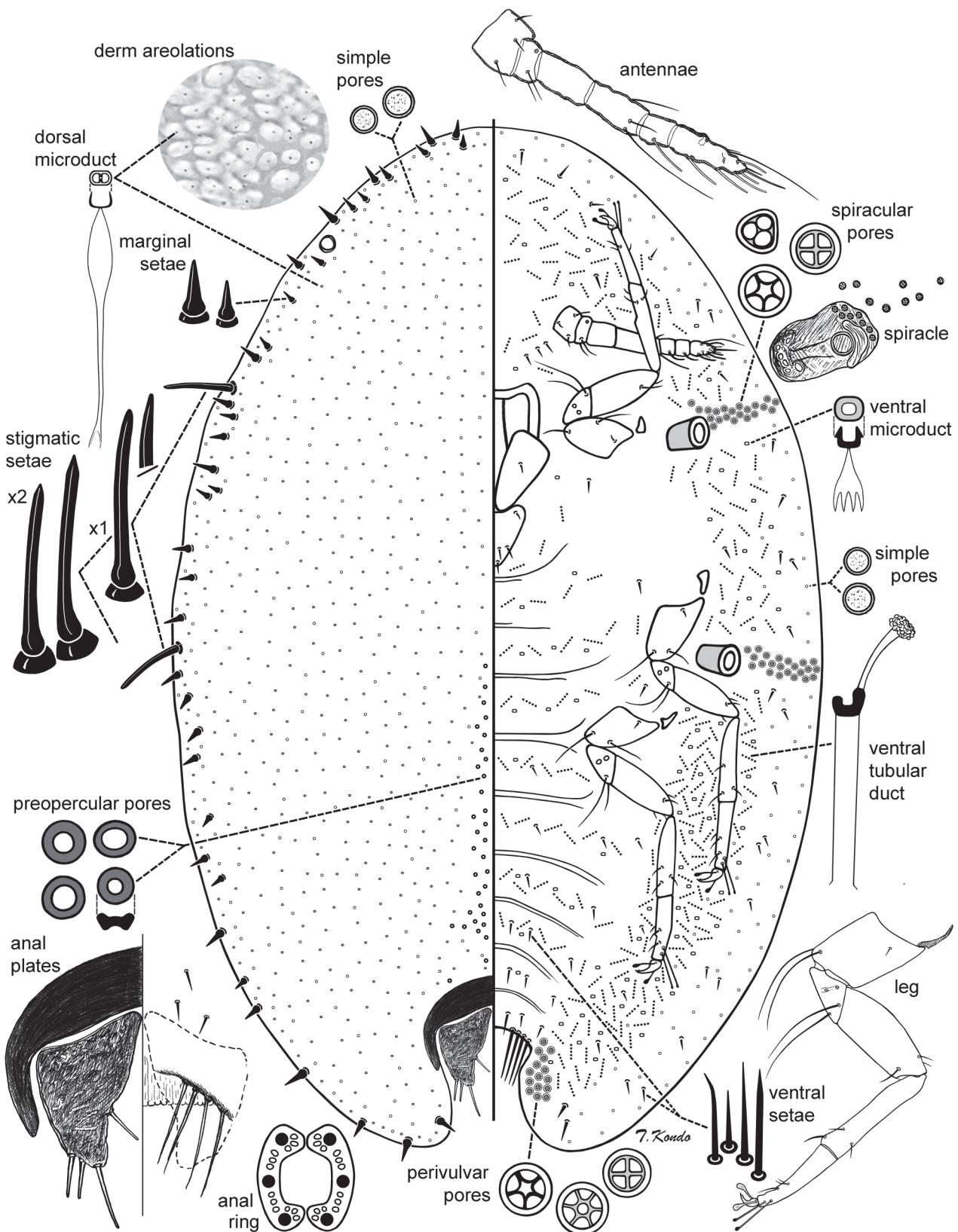


**FIGURE 1.** *Cryptinglisia* spp. on rosemary in Colombia. **A.** Two stacked specimens of *Cryptinglisia corpoica* Kondo & Montes sp. nov. covered by some sooty mold; **B.** Adult female of *C. corpoica* on twig; **C.** Two second-instar nymphs of *C. corpoica*; **D.** Rosemary plants with a low infestation of *C. corpoica*; **E.** Sooty mold symptoms associated with *C. corpoica*; **F.** An alcohol-preserved specimen of an adult female of *Cryptinglisia ica* Montes & Kondo sp. nov. Photographs A, B, C, E by O.J. Dix Luna; D by M.F. Diaz; F by J.M. Montes.

***Cryptinglisia corpoica* Kondo & Montes, sp. nov.**  
(Figs 1A, B & C; 2)

*Proposed common names.* Spanish: Escama blanda de Corpoca; English: Corpoca's rosemary scale.

**Type material studied. Holotype.** Adult female. COLOMBIA: Antioquia: San Vicente, vereda Altos de la Campiña, Finca Bioga, 18.xi.2014, coll. Maria Fernanda Diaz, ex *Rosmarinus officinalis*, ICA No. 14-1496-3: 1(1) (CTNI).



**FIGURE 2.** *Cryptinglisia corpoica* Kondo & Montes, adult female.

**Paratypes.** Same data as holotype, except: ICA No. 14-1496, 14-1496-1, 14-1496-2, 14-1496-3: 3(3) (CTNI); **Antioquia:** Marinilla, Las Mercedes, 6.15632° N, -75.33821° W, 2112 m a.s.l., 27.v.2015, coll. Andrea Villegas, ex *R. officinalis*, No. 0000047, 1(1) (ICALNDF); **Boyacá:** Villa de Leyva, vereda Monquirá, finca Villa Paola, 3.vi.2015, coll. Maria Fernanda Diaz, ex *R. officinalis*, ICA No. 15-1796, 2(2) (CTNI). **Boyacá:** Villa de Leyva, vereda Cardonal, finca La Pila, 3.vi.2015, coll. María Fernanda Diaz, ex *R. officinalis*, ICA No. 15-1797, 2(2) (CTNI); **Boyacá:** Sáchica, vereda El Espino, finca Samicha, 3.vi.2015, coll. Maria Fernanda Diaz, ex *R. officinalis*, ICA No. 15-1798, 1(1) (CTNI). **Cundinamarca:** Bogotá, vereda Chorrillo, finca Coruntas, ca 2500 m a.s.l., 4° 34' N, 74° 17' W, 12.xii.2014, coll. V. Triana and A. Castro, ex *R. officinalis*, ICA No. 1410753, 1(1) (CTNI); **Cundinamarca:** Granada, San José, finca La Conquista, 4.52508° N, -74.33865° W, 2501 m a.s.l., 31.x.2016, coll. Marcela Useche, ex *R. officinalis*, No. 0000423, 1(1) (ICALNDF), same data except: 4° 54' N, 74° 10' W, ICA No. 1607745, 1(1) (CTNI); **Cundinamarca:** Subachoque, vereda Galdamez, finca El Hato, 4° 54' N, 74° 9' W, 2722 m a.s.l., 11.ix.2015, coll. E.D. Espinosa-M., ex *R. officinalis*, 1(1) (CTNI); **Cundinamarca:** Subachoque, Galdamez, El Hato, 4.55054° N, -74.09888° W, 2665 m a.s.l., 22.v.2017, coll. Marcela Useche, ex *R. officinalis*, No. 0000442, 1(1) (ICALNDF); **Cundinamarca:** Subachoque, vereda Galdamez, finca El Hato, 4.vi.2015, coll. Oscar J. Dix Luna, ex *R. officinalis*, 33 slides (55 adult females, 2 second-instar nymphs + 9 first-instar nymphs) (CTNI), 5(5) (USNM); **Cundinamarca:** Subachoque, vereda Galdamez, finca Hacienda El Hato, 13.v.2015, coll. Angela Castro, ex *R. officinalis*, ICA No. 15-1471 4(4) (CTNI); **Cundinamarca:** Subachoque, vereda Galdamez, finca El Danubio, 4° 30'01" N, 74° 21'12" W, 2230 m a.s.l., 6.viii.2014, coll. Maria F. Diaz, ex *R. officinalis*, 3(7) (CTNI); **Cundinamarca:** Rosal, Buena Vista, Zerta, 4.87986° N, -74.25831° W, 2711 m a.s.l., 22.v.2017, coll. Marcela Useche, ex *R. officinalis*, No. 0000441, 1(1) (ICALNDF); **Cundinamarca:** Simijaca, El Pantano, Lote Santamaría, 5.30508° N, -73.47838° W, 2555 m a.s.l., 25.iv.2017, coll. Marcela Useche, ex *R. officinalis*, No. 0000180, 1(1) (ICALNDF); **Cundinamarca:** Tena, vereda Catalomonte, finca La Tartaria, 23.vi.2015, coll. María Fernanda Diaz, ex *R. officinalis*, No. 0960, No. 0957, No. 0958, 3(6) (CTNI); same data except: ICA No. 15-2372, 2(2) (CTNI).

**Adult female** (measurements based on n=50).

**Unmounted material** (Fig. 1A). Adult female in life about 1.5–4.0 mm long, 1.0–3.0 mm wide, oval, slightly convex. Test glassy, whitish to semi-transparent, of a granulose texture. Body creamy yellow to brownish. Anal plates and sclerotization around anal plates reddish brown (Figs 1A, B & D). Second-instar nymphs light yellow-green and covered by a glassy semi-transparent test (Fig. 1C).

**Slide-mounted material** (Fig. 2). Body 1.40–3.83 (1.92) mm long, 0.98–2.90 (1.56) mm wide, oval.

**Dorsum.** Derm membranous, with areolations clearly visible over entire dorsum in older specimens. Dorsal setae absent. Dorsal microducts each oval, bilocular, about 2.0 µm wide, fairly abundant, scattered over dorsum. Simple pores each 1.4–3.4 (mostly 2.0–3.0) µm wide, fairly abundant, scattered over dorsum. Dorsal tubular ducts, dorsal tubercles and pocket-like sclerotizations absent. Preopercular pores circular, with a thick rim, each about 2.5–4.0 µm wide, extending anteriorly along midline from area anterior to anal plates to about mesothorax, some pores occasionally present on area laterad to anal plates. Anal plates together subquadrate, located at about 1/5 of body length from posterior margin, each plate 97.5–115.0 (97.5–102.5) µm long, 12.5–60.0 (50.0–52.5) µm wide, anterolateral margin 50.0–80.0 (67.5–80.0) µm long, posterolateral margin 67.5–80.0 (67.5–72.5) µm long, with about 4 bluntly spinose setae on dorsal surface: 3 apical and 1 inner marginal seta; anogenital fold with 4 long, sharply spinose fringe setae; ventral subapical setae and hypopygial setae not detected; anal plates often heavily sclerotized, so structural details difficult to observe in most specimens. Anal ring bearing 6 setae. A sclerotic area present around anal plates.

**Margin.** Marginal setae each spinose and conical, with a bulbous base, straight, 12–30 µm long, some setae evidently much shorter than others, arranged in a single irregular row, with 3–10 (7–9) on each side between anterior and posterior stigmatic areas. Stigmatic clefts very shallow or absent. Stigmatic spines sharply spinose, straight or slightly curved, gradually or abruptly tapering to a point, rarely bifurcate; anterior stigmatic spines totalling 1 (rarely 2) in each anterior stigmatic area, each 51.0–112.5 (77.5–85.0) µm long; posterior stigmatic spines totalling 1 or 2 (1 on holotype) in each stigmatic area, each 68.0–120.0 (100.0–110.0) µm long. Eyes well developed, circular, domed, each 20–30 (20) µm wide, located on dorsal margin, often between marginal setae.

**Venter.** Derm entirely membranous. Perivulvar pores each 4.0–5.5 µm wide, mainly with 5 loculi (rarely a pore with 4, 6, 7 or 8 loculi), present in a group of 11–16 pores on each side along anal fold just posterior to vulvar area. Spiracular pores each 3.0–5.0 µm wide, mostly with 5 loculi (but occasional pores with 3 or 4 loculi), present in a narrow band about 2 or 3 pores wide, extending laterally from each spiracle to body margin; each anterior pore

band with 14–27 (14–15) spiracular pores, each posterior spiracular pore band with 25–40 (17–24) spiracular pores. Ventral microducts each about 2.5–3.0 µm wide, scarce on mid venter, absent from around margins but abundant in a submarginal band. Simple pores scattered on ventral margin and submargin, absent from mid venter, each pore circular, about 2.0–3.0 µm wide, similar in shape and size to simple pores on dorsum. Ventral tubular ducts present in a submarginal band and scattered on mid venter; each duct with outer ductule 17.5–20.0 µm long, inner ductule 7.5–10.0 µm long, with terminal filament ending in a flower-shaped gland. Ventral setae slender, straight or slightly bent, present on all abdominal segments and submedially around body, each 6.3–17.0 µm long; ventral submarginal setae slender, straight or slightly bent, stouter than other ventral setae, each 10–16 µm long; long prevulvar setae absent. Spiracles well developed, with a sclerotization around each spiracle, anterior spiracular sclerotization 60.0–105.0 (60.0–75.0) µm long, 42.5–92.5 (62.5–65.0) µm wide, posterior spiracular sclerotization 65.0–112.5 (60.0–77.5) µm long, 42.5–115.0 (62.5–65.0) µm wide; quinquelocular pores present within atrium, totalling about 3–8 per spiracular sclerotization, often hard to detect. Legs well developed, each coxa (excluding coxal process) 100.0–117.5 (97.5–112.5) µm long, trochanter + femur 140.0–157.5 (137.5–150.0) µm long; tibia + tarsus 187.5–230.0 (187.5–222.0) µm long, without tibio-tarsal sclerosis; claw 15.0–22.5 µm (20.0–22.5) long, with a minute denticle. Tarsal digitules both knobbed, one shorter than other, shorter digitule 37.5–42.5 (37.5–40.0) µm long, longer digitule 45.0–52.5 (45.0–50.0) µm long; claw digitules similar and broad, each 15.0–25.0 (20.0–25.0) µm long. Antennae each 182–250 (192.5–195.0) µm long, usually with 6, more rarely 7 segments (6 in holotype); fleshy setae generally present on last 3 antennal segments, although specimens with fleshy setae on last 2 antennal segments also present; segments II and IV each usually with a very long slender seta. With 3 or 4 pairs of interantennal setae, each seta 12.5–50.0 µm long. Mouthparts relatively large; clypeolabral shield 145.0–187.5 (180) µm long, 127.5–160.0 (150) µm wide; labium 1 segmented, 75.0–105.0 (92.5) µm long, 77.5–130.0 (127.5) µm wide, with 4 pairs of labial setae.

**Diagnosis.** The adult female of *C. corpoica* can be diagnosed by the combination of the following features: (1) test glassy, whitish to semi-transparent, of a granulose texture; (2) dorsal derm with areolations; (3) dorsal microducts bilocular; (4) simple pores of 1 size type; (5) dorsal tubular ducts, dorsal tubercles and pocket-like sclerotizations absent; (6) preopercular pores thick rimmed, present along midline from area anterior to anal plates anteriorly to about mesothorax; (7) anal plates together subquadrate, with about 4 bluntly spinose setae on dorsal surface, and with 4 pairs of long sharply spinose fringe setae; without ventral subapical and hypopygial setae; (8) anal ring bearing 6 setae; (9) marginal setae each spinose and conical, with a bulbous base, of 2 length types; (10) each stigmatic area with 1 or 2 stigmatic spines; (11) ventral microducts scarce on mid venter, absent from around margins but abundant in a submarginal band; (12) simple pores scattered on ventral margin and submargin, absent from mid venter; (13) long prevulvar setae absent; and (14) antennae 6 or 7 segmented.

**Etymology.** The species is named after the Corporación Colombiana de Investigación Agropecuaria [Colombian Corporation for Agricultural Research] (Corpoica). The species epithet is a noun in apposition.

**Notes.** *Cryptinglisia corpoica* sp. nov. was collected on rosemary in the departments of Antioquia, Boyaca and Cundinamarca. Sooty mold symptoms were found associated with *C. corpoica* (Fig. 1E).

### *Cryptinglisia ica* Montes & Kondo

(Figs 1F, 3)

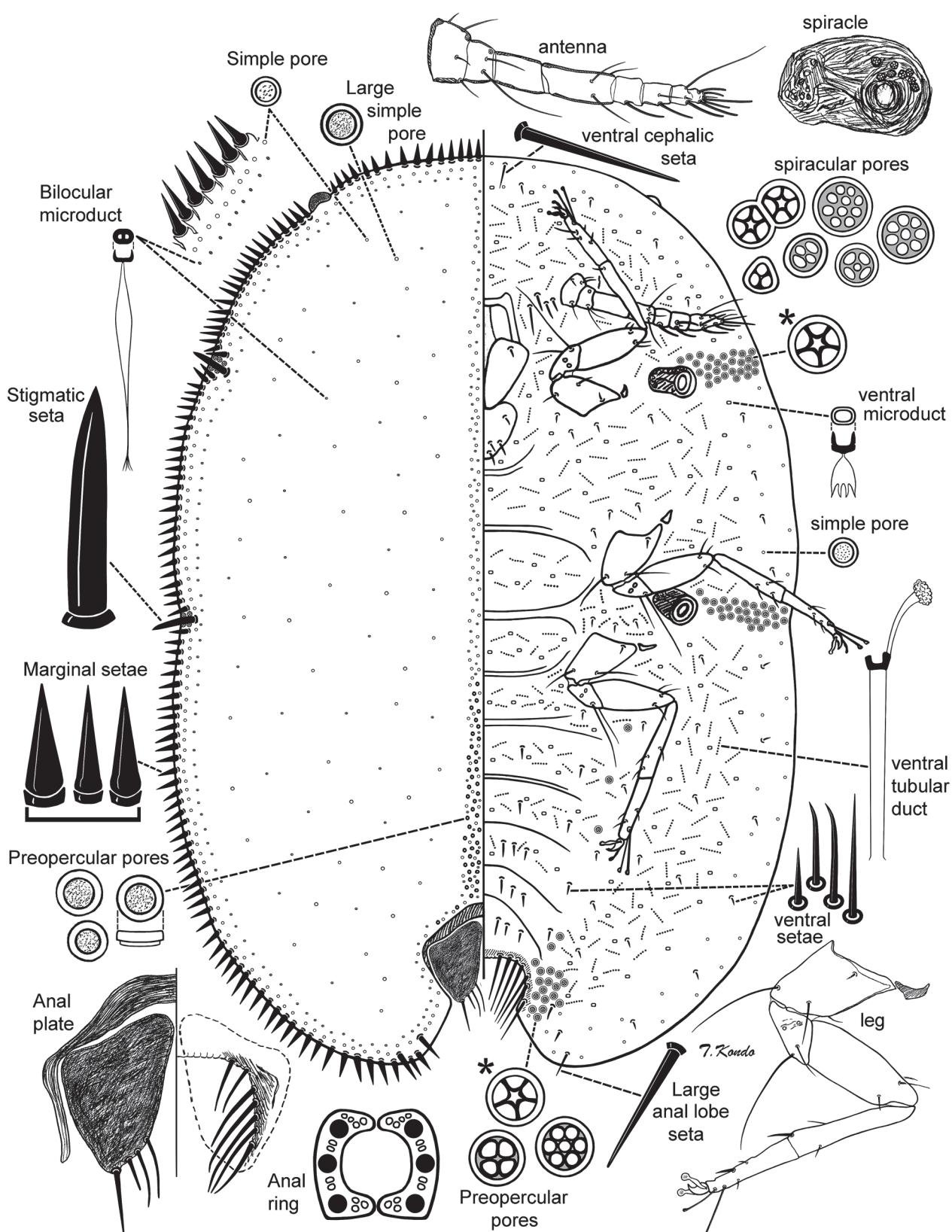
*Proposed common names.* Spanish: Escama blanda del Ica; English: Ica's rosemary scale.

**Type material studied. Holotype.** Adult female. COLOMBIA: Antioquía: San Vicente, vereda El Porvenir, finca Villa María, 22.ix.2014, coll. María Fernanda Diaz, ex *Rosmarinus officinalis*, ICA No. 14-991-5, 1(1) (CTNI).

**Paratypes.** Same data as Holotype except: No. 14-991: 9(9), No. 14-991-2: 1(1), No. 14-991-4: 1(1) (CTNI), 5(5) (USNM); Antioquía: municipio Rionegro, vereda Rio Abajo, finca Cultivos del Río, 18.xi.2014, coll. María Fernanda Diaz, ex *R. officinalis*, ICA No. 14-1494-1, 14-1494-2, 14-1494-3, 14-1494-4, 14-1494-5, 5(5) (CTNI).

**Adult female** (measurements based on n=22)

**Unmounted material** (Fig. 1F). Adult female oval, slightly convex, border of margins thickened. Alcohol-preserved specimens reddish brown to yellowish brown. Insects covered by a shiny and vitreous layer of semi-transparent, striated brittle wax; with a visible midline that divides the wax cover into two halves (Fig. 1F).



**FIGURE 3.** *Cryptinglisia ica* Montes & Kondo, adult female.

**Slide-mounted material** (Fig. 3). Body 1.23–1.95 (1.27) mm long, 0.78–1.48 (0.87) mm wide, oval.

*Dorsum*. Derm membranous, without areolations. In older specimens a dorsal longitudinal sclerotized line becomes visible. Dorsal setae absent. Dorsal microducts oval, bilocular, each about 1.8–2.0  $\mu\text{m}$  wide, scattered over dorsum, present in a continuous row around body margin and abundant on a mid-longitudinal line, intermixed with simple pores and preopercular pores. Simple pores of 2 sizes: i) a small pore, each 2.0–2.2  $\mu\text{m}$  wide, scattered throughout dorsum, more abundant in a continuous row around body margin and in a mid-dorsal longitudinal line; and a larger pore, each about 3.0  $\mu\text{m}$  wide, sparsely scattered over dorsum. Dorsal tubular ducts, dorsal tubercles and pocket-like sclerotizations absent. Preopercular pores circular, each about 2.5–5.0  $\mu\text{m}$  wide, with a thick rim, extending along midline from area anterior to anal plates anteriorly to about mesothorax or metathorax, some pores occasionally present on area laterad to anal plates. Anal plates together subquadrate, plates located at about 1/5 of body length from posterior margin, each plate 110.0–127.5 (120.0–122.5)  $\mu\text{m}$  long, 62.5–82.5 (70.0–72.5)  $\mu\text{m}$  wide, anterolateral margin 75.0–100.0 (77.5–87.5)  $\mu\text{m}$  long, posterolateral margin 70.0–95.0 (90.0–92.5)  $\mu\text{m}$  long, with about 4 bluntly spinose apical setae, 1 pair of sharply spinose fringe setae, and about 5 long ventral subapical setae; hypopygial setae not detected. Anal ring bearing 6 setae. A sclerotic area present around anal plates.

*Margin*. Marginal setae spinose and conical, straight, present in a continuous row around body, most setae each 25.0–37.5  $\mu\text{m}$  long, longest setae at apex up to 50  $\mu\text{m}$  long, each base 10.0–12.5  $\mu\text{m}$  wide at widest point (width of sclerotized setal socket); 1 or 2 pairs of marginal setae present next to stigmatic setae, often on dorsal submargin; with about 20–27 (25) setae on each side between anterior and posterior stigmatic areas. Stigmatic clefts very shallow or absent. Stigmatic spines sharply spinose, straight, gradually tapering to a point, present on dorsal submargin, with 1 stigmatic spine in each stigmatic area, anterior stigmatic setae each 60.0–70.0 (60.0–62.5)  $\mu\text{m}$  long, posterior stigmatic setae each 62.5–80 (62.5–65.0)  $\mu\text{m}$  long. Eyes each about 25.0–32.5 (25)  $\mu\text{m}$  wide, located on margin between marginal setae.

*Venter*. Derm entirely membranous. Perivulvar pores each 4.0–6.0  $\mu\text{m}$  wide, each with mainly 5 loculi, rarely with 4 or 6 loculi, present in a group of about 5–20 pores on each side along anal fold just posterior to vulvar area, with a few pores present anteriorly up to area of posterior legs. Spiracular pores each 4.0–6.0  $\mu\text{m}$  wide, mostly with 5 loculi, but with occasional pores with 3 or 4 loculi and 6–10 loculi, pores often fused, largest pores 6.5–7.5  $\mu\text{m}$  wide; present in a band about 2–5 pores wide, with line of pores extending laterally from each spiracle to body margin and slightly onto dorsum up to base of each stigmatic seta. Ventral microducts each 2.0–3.0  $\mu\text{m}$  wide, scattered throughout venter, most abundant in a submarginal band, absent from anterior to vulva on last 2 abdominal segments and around body margin. Simple pores present on ventral margin only, scattered, absent from elsewhere on venter, each pore circular, about 2.0–2.2  $\mu\text{m}$  wide, similar in shape and size to the smaller simple pores on dorsum. Ventral tubular ducts present in a submarginal band and also scattered medially on venter, on head, thorax and abdomen, absent from last 2 abdominal segments anterior to vulva and body margin; outer ductule 30.0–50.0  $\mu\text{m}$  long, inner ductule 15.0–22.5  $\mu\text{m}$  long, with terminal filament ending in a flower-shaped gland. Ventral setae slender, straight or slightly bent, each 7.5–15.0  $\mu\text{m}$  long, present on all abdominal segments; setae on last 3 abdominal segments thicker, 15.0–20.0  $\mu\text{m}$  long; ventral submarginal setae present in a single row, stouter than other ventral setae, each 10.0–17.5  $\mu\text{m}$  long; with a pair of thick and long ventral cephalic setae, each 32.5–42.5  $\mu\text{m}$  long, and a thick and long large anal lobe seta present at apex of each posterior anal lobe, each seta tapering to a point, rarely bifurcate, 20.0–42.5  $\mu\text{m}$  long. Spiracles well developed, anterior spiracular peritremes each 70.0–80.0 (70.0–72.5)  $\mu\text{m}$  long, 42.5–50.0 (42.5–47.5)  $\mu\text{m}$  wide, posterior peritremes each 65.0–77.5 (65.0–72.5)  $\mu\text{m}$  long, 42.5–50.0 (45.0–47.5)  $\mu\text{m}$  wide, with a slight sclerotization around each spiracle; quinquelocular pores present within atrium, totalling about 3–10 per spiracular sclerotization, often hard to detect. Legs well developed, each coxa (excluding coxal process) 107.5–127.5 (107.5–122.5)  $\mu\text{m}$  long, trochanter + femur 157.5–175.0 (157.5–165.0)  $\mu\text{m}$  long; tibia + tarsus 200.0–225.0 (200.0–222.5)  $\mu\text{m}$  long, without a tibio-tarsal sclerosis; claw 20.0–25.0 (20.0–22.5)  $\mu\text{m}$  long, without a denticle. Tarsal digitules similar, knobbed, shorter digitule 35.0–42.5 (35.0–42.5)  $\mu\text{m}$  long, longer digitule 40.0–62.5 (40.0–62.5)  $\mu\text{m}$  long; claw digitules similar and broad, each 20.0–25.0 (22.5–25.0)  $\mu\text{m}$  long. Antennae each 230–270.0 (235–250)  $\mu\text{m}$  long, 7 or 8 segmented (one specimen with a 6-segmented antenna on left side), with fleshy setae present on last 3 (rarely 2) antennal segments; with a very long, slender seta present on segment II. Interantennal setae numbering 3 or 4 pairs, each seta 10.0–67.0  $\mu\text{m}$  long. Mouthparts relatively large; clypeolabral shield 160.0–200.0 (172.5)  $\mu\text{m}$  long, 145.0–165.0 (145.0)  $\mu\text{m}$  wide; labium 1 segmented, 57.5–87.5 (82.5)  $\mu\text{m}$  long, 95.0–125.0 (97.5)  $\mu\text{m}$  wide, with 4 pairs of labial setae; basal part of labium membranous.

**Diagnosis.** The adult female of *C. ica* can be diagnosed by the combination of the following features: (1) insects covered by a shiny and vitreous layer of semi-transparent, striated, brittle wax; with a visible midline that divides the wax cover into 2 halves; (2) dorsal derm membranous, without areolations; (3) dorsal microducts bilocular, scattered over dorsum and in a continuous row around body margin, and abundant in a mid-longitudinal line; (4) dorsal simple pores of 2 sizes, (5) preopercular pores each with a thick rim, present along midline from area anterior to anal plates anteriorly to about mesothorax or metathorax; (6) anal plates together subquadrate, each plate with about 4 bluntly spinose apical setae, 1 pair of sharply spinose fringe setae, and about 5 long ventral subapical setae, but without hypopygial setae; (7) anal ring bearing 6 setae; (8) marginal setae of 1 type, spinose and conical, straight, present in a continuous row around body; (9) 1 stigmatic spine per stigmatic area; (10) ventral microducts scattered throughout venter, most abundant in a submarginal band, absent from anterior to vulva on last two abdominal segments and from around margins; (11) simple pores present on ventral margin only, scattered, absent from elsewhere on venter; (12) ventral tubular ducts in a submarginal band and also scattered medially on head, thorax and abdomen, absent from last 2 abdominal segments anterior to vulva and along body margin; (13) a pair of submarginal thick, large ventral setae present anteriorly on head, 1 also present at apex of each anal lobe; (14) antennae each 7 or 8 segmented.

**Etymology.** The species is named after the Instituto Colombiano Agropecuario [Colombian Agricultural and Livestock Institute] (ICA). The species epithet is a noun in apposition.

**Notes.** *Cryptinglisia ica* sp. nov. was found on rosemary in the department of Antioquia, Colombia.

**Other material studied.** *Saissetia coffeae* (Walker). COLOMBIA: Cundinamarca: Municipio de Subachoque, vereda Galdamez, Hacienda el Hato, 4.91608° N, -74.16416° W, 4.xii.2014, coll. Angela Castro/Vicente Triana, ex *Rosmarinus officinalis*, No. 0000004, 1(1) (ICALNDF); Cundinamarca: municipio de Anolaima, vereda La Pica, finca Las Teresitas, 4.78739° N, -74.41674° W, 2309 m a.s.l., 5.ix.2017. coll. Karen Morales, ex *R. officinalis*, No. 0000272, 2(2) (ICALNDF); Cundinamarca: municipio de Albán, vereda Trinidad, finca Villa Mercedes, 4.52491° N, -74.2898° W, 1711 m a.s.l., 5.xi.2017, coll. Karen Morales, ex *R. officinalis*, No. 0000270, 3(3) (ICALNDF); Cundinamarca: municipio de El Rosal, vereda Punta de Cuero, finca Cristianía, 4.83935° N, -74.2591° W, 2589 m a.s.l., 5.xi.2017, coll. Karen Morales, ex *R. officinalis*, No. 0000271, 3(4) (ICALNDF); Cundinamarca: municipio de La Ceja, vereda San Nicolás, finca Claro de Luna, 22.ix.2014, coll. María Fernanda Díaz, ex *R. officinalis*, No. 0000389, 1(1) (ICALNDF).

*Parasaissetia nigra* (Nietner). Colombia: Antioquia: Municipio de Guarne, vereda Chaparral, finca Pure organics, 22.ix.2014, coll. María Fernanda Díaz, ex *R. officinalis*, No. 0000390, 3(3) (ICALNDF).

## Discussion

In Colombia, 44 species of soft scales are currently known; with the addition of the two new species of *Cryptinglisia* herein described, the total is elevated to 46. Besides the two species of *Cryptinglisia*, two other soft scale species were also found for the first time feeding on *R. officinalis*: *Saissetia coffeae* (Walker) and *Parasaissetia nigra* (Nietner), increasing the number of species recorded on rosemary to 12.

The genus *Cryptinglisia* has a disjunct distribution, with half of the species described from the southern part of Africa (*C. elytopappi*, *C. lounsburyi*, *C. millari* and *C. zizyphi*) and the other half from South America (*C. chilensis*, *C. corpoica* sp. nov., *C. ica* sp. nov. and *C. patagonica*). The African species *C. lounsburyi* has also been reported from Argentina (Granara de Willink 1999) and Italy (Marotta 1987), where they were probably introduced. Further morphological studies based on the adult males and first-instar nymphs and molecular studies may help further elucidate the relationships of the Colombian species of *Cryptinglisia* with other species currently included in the genus.

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